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DECLARATION

I, TAKAO OCHI, a Japanese Patent Attorney registered No. 10149, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority documents of Japanese Patent Application No. 10-306182 filed on October 27, 1998 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 16th day of December, 2002

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PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this office.

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HEAD SUBSTRATE, PRINTER HEAD AND PRINTER

[Claims]

[Claim 1] A head substrate, for a printer head that is detachably mounted to a printer main body, characterized by comprising:

a plurality of external connection terminals for externally and individually entering various signals for a printing operation that include at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal;

printing execution means for executing a printing operation when said printing image signal and said printing clock signal are externally entered through said external connection terminals while said binary logic signal is in a first state;

data memory means for executing a memory access which is at least either of data writing and data readout;

memory access means for, when a predetermined access permission signal is externally entered, executing the memory access to said data memory means at a timing corresponding to a memory clock signal; and

terminal sharing means for transmitting, to said

memory access means, said binary logic signal externally entered to said external connection terminals, and, also as said memory clock a specific signal entered at one of said external connection terminals,

wherein said memory access means identifies said binary logic signal in a second state as said access permission signal.

[Claim 2]

A head substrate according to claim 1, wherein said printing execution means prints a printing image signal serially entered at a specified one of said external connection terminals; and wherein said terminal sharing means serially supplies said memory access means with an input signal at said specified external connection terminal, at which said printing image signal is serially entered, as the writing data.

[Claim 3]

A head substrate according to claim 1, wherein said printing execution means prints a printing image signal serially entered at a specified one of said external connection terminals; and wherein said terminal sharing means serially supplies an external connection terminal, serially receiving said printing image signal, with data read from said memory access means.

[Claim 4]

A head substrate according to claim 1, wherein said printing execution means prints a printing image signal entered in parallel at multiple specified external connection terminals; and wherein said terminal sharing means supplies said memory access means in parallel with signals entered at said multiple external connection terminals receiving in parallel said printing image signal.

[Claim 5]

A head substrate according to claim 1, wherein said printing execution means prints a printing image signal entered in parallel at multiple specified external connection terminals; and wherein said terminal sharing means supplies said multiple specified external connection terminals, receiving in parallel said printing image signal, in a parallel manner with data read from said memory access means.

[Claim 6]

A head substrate according to one of claims 1 to 5, wherein said printing execution means includes:

a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of external connection terminal and is serially input to another specified external connection terminal,

wherein said terminal sharing means transmits, to said memory access means, said reset signal of said shift register as a binary logic signal that serves as an access permission signal.

[Claim 7]

A head substrate according to one of claims 1 to 5, wherein said printing execution means includes:

a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of said external connection terminals and is serially entered to another specified external connection terminal; and

a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of said external connection terminals and is output in parallel from said shift register,

wherein said terminal sharing means transmits, to said memory access means, said reset signal of said latch circuit as a binary logic signal that serves as an access permission signal.

[Claim 8]

A head substrate according to one of claims 1 to 5, wherein said printing execution means includes:

a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at a one specified of said external connection terminals and is serially input to another specified external connection terminal; and

a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal and is output in parallel from said shift register,

wherein said terminal sharing means transmits, to said memory access means, said reset signal as a binary logic signal that serves as an access permission signal.

[Claim 9]

A head substrate according to one of claims 1 to 5, wherein said printing execution means includes:

a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at one specified external connection terminal and is serially entered to another specified external connection terminal; and

a latch circuit for, at a timing corresponding to a latch signal externally entered to a specific one of said external connection terminals, temporarily holding and

outputting in parallel a printing image signal that is output in parallel from said shift register,

wherein said terminal sharing means transmits, to said memory access means, said reset signal of said latch circuit as a binary logic signal that serves as an access permission signal.

[Claim 10]

A head substrate according to one of claims 7 to 9, wherein said printing execution means is provided with plural recording elements for outputting said printing image signal output in parallel from said latch circuit, corresponding to a printing pulse signal externally input to a specified one of said external connection terminals.

[Claim 11]

A head substrate according to one of claims 6 to 10, wherein said terminal sharing means supplies said memory access means with said printing clock signal of said shift register as a memory clock signal.

[Claim 12]

A head substrate according to one of claims 1 to 11, wherein said data memory means executes both data writing and data readout as a memory access operation, while said memory access means selectively executes either of data writing and data readout according to an externally entered mode switching signal; and wherein, as said mode switching

signal, said terminal sharing means supplies said memory access means with a signal entered at a specified one of said external connection terminals.

[Claim 13]

A head substrate according to one of claims 1 to 12, wherein said printing execution means externally receives said driving electric power from a specified external connection terminal; and wherein said terminal sharing means supplies said memory access means with said driving electric power for said printing execution means.

[Claim 14]

A head substrate according to one of claims 1 to 13, wherein said external connection terminals, said printing execution means, said data memory means, said memory access means and said terminal sharing means are composed of films formed on a base substrate, whereby said printer head can be formed compact and light.

[Claim 15]

A printer head, which is detachably mounted to a printer main body, comprising a head substrate according to one of claims 1 to 14.

[Claim 16]

A printer head, which is detachably mounted to a printer main body, characterized by comprising:

a plurality of external connection terminals for

externally and individually entering various signals for a printing operation that include at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal;

printing execution means for executing a printing operation when said printing image signal and said printing clock signal are externally entered through said external connection terminals while said binary logic signal is in a first state;

data memory means for executing a memory access which is at least either of data writing and data readout;

memory access means for, when a predetermined access permission signal is externally entered, executing the memory access to said data memory means at a timing corresponding to a memory clock signal; and

terminal sharing means for transmitting, to said memory access means, said binary logic signal externally entered to said external connection terminals, and, also as said memory clock a specific signal entered at one of said external connection terminals,

wherein said memory access means identifies said binary logic signal in a second state as said access permission signal.

[Claim 17]

A printer comprising:

a printer head according to claim 15 or 16;

printing input means for transmitting, to said plurality of external connection terminals of said printer head, various individual signals, such as a printing image signal and a printing clock signal, together with a binary logic signal in a first state, and for permitting said printing execution means to perform a printing operation; and

access control means for transmitting, to said external connection terminals of said printer head, a memory clock signal and other signals together with a binary logic signal in a second state, and permitting said memory access means to perform memory access.

[Claim 18]

A printer according to claim 17, wherein said printer head includes a head substrate according to claim 2; wherein said printing input means serially transmits said printing image signal to one of said external connection terminals; and wherein said access control means may transmit write data for said memory access means to said external connection terminal whereat said printing image signal is serially input.

[Claim 19]

A printer according to claim 17, wherein said printer

head includes a head substrate according to claim 3; wherein said printing input means serially transmits said printing image signal to one of said external connection terminals; and wherein said access control means transmits read data for said memory access means to said external connection terminal whereat said printing image signal is serially input.

[Claim 20]

A printer according to claim 17, wherein said printer head includes a head substrate according to claim 4; wherein said printing input means transmits said printing image signal to one of said external connection terminals in parallel; and wherein said access control means transmits write data for said memory access means to said external connection terminal whereat said printing image signal is input in parallel.

[Claim 21]

A printer according to claim 17, wherein said printer head includes a head substrate according to claim 5; wherein said printing input means transmits said printing image signal to one of said external connection terminals in parallel; and wherein said access control means transmits read data for said memory access means to said external connection terminal whereat said printing image signal is input in parallel.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a head substrate wherein various film layers are laminated on one base substrate, a printer head utilizing such a head substrate, and a printer utilizing such a printer head.

[0002]

[Description of Prior Art]

There are already commercialized various printers, including such a printer having a replaceable printer head as an ink jet printer. As an example, in the ink jet printer, plural external connection terminals are provided in a printer main body and a printer head, and these terminals are mutually connected when the printer head is mounted on the printer main body.

[0003]

In such state, the printer main body can transfer various signals such as a printing image signal and a printing clock signal to the printer head, so that the printer head can execute the printing of the externally entered image signal at a timing corresponding to the printing clock signal.

[0004]

In such a printer with the replaceable printer head,

it is now proposed to provide a printer head with various data such as ID (identification) data of the head in readable manner. For this purpose, it is proposed to provide a printer head with data memory means such as ROM (read only memory), as disclosed in the Japanese Patent Application Laid-Open Nos. 3-126560 and 8-177732 and the U.S. Patent Nos. 5,504,507 and 5,363,134.

[0005]

[Problem to be solved by the Invention]

This type of printer head can be interchangeable mounted on the printer main body and can also store various data by the data memory means in arbitrarily readable manner.

[0006]

However, in case the printer head is provided with the data memory means such as ROM, it is necessary to provide the printer head and the printer main body with exclusive plural connection terminals for executing the access to the memory. Such configuration increases the dimension of the external connection terminals in the printer head and in the printer main body, with a loss in the productivity thereof.

[0007]

In consideration of the foregoing, one object of the present invention is to provide a head substrate capable of

executing the printing operation and the memory access while minimizing the increase in the external connection terminals in the presence of the data memory means, a printer head utilizing such a head substrate and a printer utilizing such a printer head.

[0008]

[Means to solve the Problem]

According to the present invention, a head substrate for a printer head that is detachably mounted to a printer main body is characterized by comprising: a plurality of external connection terminals for externally and individually entering various signals for a printing operation that include at least a binary logic signal, the binary state of which corresponds to the presence or absence of the printing operation, a printing image signal and a printing clock signal; printing execution means for executing a printing operation when the printing image signal and the printing clock signal are externally entered through the external connection terminals while the binary logic signal is in a first state; data memory means for executing a memory access which is at least either of data writing and data readout; memory access means for, when a predetermined access permission signal is externally entered, executing the memory access to the data memory means at a timing corresponding to a memory clock signal;

and terminal sharing means for transmitting, to the memory access means, the binary logic signal externally entered to the external connection terminals, and, also as the memory clock a specific signal entered at one of the external connection terminals, wherein the memory access means identifies the binary logic signal in a second state as the access permission signal.

[0009]

Therefore, when the printer head having the head substrate of this invention is mounted to the printer main body, at the execution of the printing operation, various signals for the printing operation are supplied from the printer main body to the external connection terminals of the head substrate. When the printing execution means can execute the printing operation when the printing image signal and the printing clock signal are externally entered in the first state of the binary logic signal, at the execution of memory access, various signals for the memory access are supplied from the printer main body to the external connection terminals of the head substrate. Therefore, the memory access means can execute access to the data memory means in a timing corresponding to the memory clock signal, when the access permission signal is externally entered. Since the terminal sharing means supplies the memory access means with the binary logic

signal entered into the external connection terminal and such memory access means recognizes the binary logic signal of the second state as the access permission signal, there is not required the terminal exclusive for transferring such access permission signal to the memory access means.

[0010]

In the above-described head substrate, the printing execution means may print the printing image signal serially input at a specified one of the external connection terminals, and the terminal sharing means may serially supply the memory access means with a signal entered at the specified external connection terminal, at which the printing image signal is serially entered, as the writing data.

[0011]

In the above-described head substrate, the printing execution means may print the printing image signal serially input at a specified one of the external connection terminals, and the terminal sharing means may serially supply an external connection terminal, serially receiving the printing image signal, with the data read from the memory access means.

[0012]

In the above-described head substrate, the printing execution means may print the printing image signal input

in parallel at multiple specified external connection terminals, and the terminal sharing means may supply the memory access means in parallel with signals entered at multiple specified external connection terminals receiving in parallel the printing image signal.

[0013]

In the above-described head substrate, the printing execution means may print the printing image signal input in parallel at specified ones of the external connection terminals, and the terminal sharing means may supply the plural external connection terminals, receiving parallel input of the printing image signal, in parallel manner with data read from the memory access means.

[0014]

In the above-described head substrate, the printing execution means may include: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of external connection terminal and is serially input to another specified external connection terminal, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the shift register as a binary logic signal that serves as an access permission signal.

[0015]

In the above-described head substrate, the printing execution means may include: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of the external connection terminals and is serially entered to another specified external connection terminal; and a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of the external connection terminals and is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the latch circuit as a binary logic signal that serves as an access permission signal.

[0016]

In the above-described head substrate, the printing execution means may include: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at a one specified of the external connection terminals and is serially input to another specified

external connection terminal; and a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal and is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal as a binary logic signal that serves as an access permission signal.

[0017]

In the above-described head substrate, the printing execution means may include: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at one specified external connection terminal and is serially entered to another specified external connection terminal; and a latch circuit for, at a timing corresponding to a latch signal externally entered to a specific one of the external connection terminals, temporarily holding and outputting in parallel a printing image signal that is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the latch circuit as a binary logic signal that serves as an access permission signal.

[0018]

In the above-described head substrate, the printing execution means may be provided with plural recording elements for outputting the printing image signal output in parallel from the latch circuit, corresponding to a printing pulse signal externally input to a specified one of the external connection terminals.

[0019]

In the above-described head substrate, the terminal sharing means may supply the memory access means with the printing clock signal of the shift register as a memory clock signal.

[0020]

In the above-described head substrate, the data memory means may execute both data writing and data readout as the memory access operation, while the memory access means selectively executes either of data writing and data readout according to an externally entered mode switching signal, and as the mode switching signal, the terminal sharing means may supply the memory access means with the input signal to a specified one of the external connection terminals.

[0021]

In the above-described head substrate, the recording execution means may externally receive the driving electric power from a specified external connection terminal, and

the terminal sharing means may supply the memory access means with the driving electric power for the recording execution means.

[0022]

In the above-described head substrate, the external connection terminals, printing execution means, data memory means, memory access means and terminal sharing means may be composed of films formed on a base substrate, whereby the printer head can be formed compact and light.

[0023]

A first printer head according to the present invention, which is detachably mounted to a printer main body, comprises a head substrate according to this invention.

[0024]

According to the present invention, a second printer head that is detachably mounted to a printer main body is characterized by comprising: a plurality of external connection terminals for externally and individually entering various signals for a printing operation that include at least a binary logic signal, the binary state of which indicates whether the printing operation is executed or not, a printing image signal and a printing clock signal; printing execution means for executing a printing operation when the printing image signal and the printing

clock signal are externally entered through the external connection terminals while the binary logic signal is in a first state; data memory means for executing a memory access which is at least either of data writing and data readout; memory access means for, when a predetermined access permission signal is externally entered, executing the memory access to the data memory means at a timing corresponding to a memory clock signal; and terminal sharing means for transmitting, to the memory access means, the binary logic signal externally entered to the external connection terminals, and, also as the memory clock a specific signal entered at one of the external connection terminals, wherein the memory access means identifies the binary logic signal in a second state as the access permission signal.

[0025]

A printer according to the present invention comprises: a printer head according to this invention; printing input means for transmitting, to the plurality of external connection terminals of the printer head, various individual signals, such as a printing image signal and a printing clock signal, together with a binary logic signal in a first state, and for permitting the printing execution means to perform a printing operation; and access control means for transmitting, to the external connection

terminals of the printer head, a memory clock signal and other signals together with a binary logic signal in a second state, and permitting the memory access means to perform memory access.

[0026]

According to the thus arranged printer, the printing input means may serially transmit the printing image signal to one of the external connection terminals, and the access control means may transmit write data for the memory access means to the external connection terminal whereat the printing image signal is serially input.

[0027]

According to the thus arranged printer, the printing input means may serially transmit the printing image signal to one of the external connection terminals, and the access control means may transmit read data for the memory access means to the external connection terminal whereat the printing image signal is serially input.

[0028]

According to the thus arranged printer, the printing input means may transmit the printing image signal to one of the external connection terminals in parallel, and the access control means may transmit write data for the memory access means to the external connection terminal whereat the printing image signal is input in parallel.

[0029]

According to the thus arranged printer, the printing input means may transmit the printing image signal to one of the external connection terminals in parallel, and the access control means may transmit read data for the memory access means to the external connection terminal whereat the printing image signal is input in parallel.

[0030]

Various means referred to in the present invention may be suitably so formed as to realize their functions, and include, for example, an exclusive hardware, a computer provided with appropriate functions by a program, functions realized within a computer by an appropriate program, and combinations thereof.

[0031]

[Embodiments]

An embodiment of the present invention will be explained in the following, with reference to the attached drawings, in which Fig. 1 is a block diagram showing the circuit configuration of the head substrate in an embodiment of the present invention; Fig. 2 is an external perspective view of a printer; Fig. 3 is a schematic block diagram showing the circuit configuration of the printer; and Figs. 4 to 8 are block diagrams showing the circuit configuration in variations of the head substrate.

[0032]

As shown in Fig. 5, an image processing system 100 of the present embodiment is provided with a host computer 200 constituting a central processing unit and an ink jet printer 300 constituting a printing apparatus, which are connected through a communication cable 210.

[0033]

The ink jet printer 300 of the present embodiment is provided, as shown in Fig. 2, with a printer head 400, which is composed of a head substrate 401 and a cover member (not shown). As shown in Fig. 1, the head substrate 401 is provided with a base substrate 410, on the surface of which various members are formed with films and others.

[0034]

In the head substrate 401 of the present embodiment, the front edge portion of the surface of the base substrate 410 bears plural heater elements 411 as printing elements, constituting a heater portion 412. Ends of the plural heater elements 411 are connected respectively to the source electrodes of plural power transistors 413, which constitute a driver circuit 414.

[0035]

The other ends of the plural heater elements 411 and the drain electrodes of the plural power transistors 413 are connected to a pair of heater power supply terminals

415, 416 constituting the external connection terminals and the gate electrodes of the plural power transistors 413 are electrically connected respectively to plural AND gates 418 of a heater logic circuit 417. The heater logic circuit 417, the driver circuit 414 and the heater unit 412 constitute printing execution means.

[0036]

The heater element 411 is composed of a film for example of tantalum nitride, tantalum-aluminum, tantalum-silicon nitride etc. and generates heat by a driving electric power supplied from the driver circuit 414 through the heater power supply terminals 415, 416.

[0037]

These plural AND gates 418 are matrix wired in plural control blocks, and plural block terminals 419 constituting the external connection terminals are connected to the plural AND gates 418 in each block. Also the plural AND gates 418 are connected to a pulse terminal 420 which is an external connection terminal, and to a latch circuit 421 which is connected in parallel to a shift register 422.

[0038]

The latch circuit 421 and the shift register 422 are connected in common to a reset terminal 423 constituting an external connection terminal, and also respectively connected to clock terminals 424, 425 constituting also the

external connection terminals. The shift register 422 is also connected to a data terminal 426, which constitutes another external connection terminal.

[0039]

The block terminal 419 receives a selection signal for selecting the plural control blocks of the plural heater elements 411, while the pulse terminal 420 receives a printing pulse signal for controlling the heat generating time of the heater element 411. The reset terminal 423 receives a reset signal, for resetting the latch circuit 421 and the shift register 422, as a binary logic signal the binary state of which corresponds to the presence or absence of the printing operation.

[0040]

The clock terminal 424 receives a latch signal for controlling the data latching operation of the latch circuit 421, and the clock terminal 425 receives a printing clock signal for determining the frequency of data shifting in the shift register 422.

[0041]

The data terminal 426 receives a serial printing image signal, which is converted into by the shift register 422 into a parallel printing signal, which is temporarily held by the latch circuit 421 and is supplied through the AND gages 418 to the driver circuit 414, whereby the plural

heater elements 411 generate heat corresponding the printing image signal.

[0042]

On the base substrate 410, there is also formed a sensor unit 430 composed of a temperature sensor and a temperature holding sensor, and the sensor unit 430 is connected to a pair of sensor terminals 431 constituting the external connection terminals. The external connection terminals also include a pair of power supply terminal 432, 433 which are connected to various units.

[0043]

The sensor unit 430 executes heating for heat-retaining of the base substrate 410 and measurement of temperature thereof, and the sensor terminal 431 receives a control signal for the sensor unit 430. Power supply terminals 432, 433 receive the driving electric power to be supplied to various units, including the heater logic circuit 417.

[0044]

In the head substrate 401 of the present embodiment, there is formed a fuse ROM 441 as data memory means on the surface of the base substrate 410, and a fuse logic circuit 442 constituting memory access means is formed so as to surround the fuse ROM 441.

[0045]

Various data, such as the ID code of the printer head 400 and the function characteristics of the heater unit 412, are recorded in the fuse ROM 441 prior to the shipment, and the heater logic circuit 442 executes memory access, including the data recording and the data reading, to the fuse ROM 441. The fuse ROM 441 in the present embodiment is provided with a memory capacity of equal to or smaller than 100 bits, since the data to be stored therein are the ID code and the function characteristics as explained above.

[0046]

In the printer head 400 of the present embodiment, the fuse logic circuit 442 is connected in common to the aforementioned external connection terminals 423, 425, 426 connected to the printing logic circuit 417, through a signal wiring 444 constituting terminal sharing means.

[0047]

Consequently, the reset signal for the shift register 422 and the latch circuit 421, entered externally to the reset terminal 423, is also supplied to the fuse logic circuit 442 through the signal wiring 444, whereby the fuse logic circuit 442 recognizes the reset signal of a second state as an access permission signal.

[0048]

Also the input signal for the shift register 422, entered externally to the clock terminal 425, is supplied

as a memory clock signal to the fuse logic circuit 442, whereby the data read therefrom are serially transferred through a signal wiring 446 to the data terminal 426.

[0049]

The fuse logic circuit 442, being enabled for memory access to the fuse ROM 441 upon recognizing the access permission signal as explained above, reads the data stored in the fuse ROM 441 if the memory clock signal is externally entered in this state.

[0050]

The fuse logic circuit 442 is also connected to a pair of memory power supply terminals 447, 448 constituting external connection terminals, and the fuse logic circuit 442 executes the memory access by the driving electric power supplied through these terminals 447, 448.

[0051]

For the head substrate 401 of this embodiment, a cover member is formed of a sealing member constituting partitions and a cover substrate. This cover member is adhered to the surface of the head substrate 401 to form, on the surface of the head substrate 401, nozzles corresponding to the heater elements, ink supply paths and an ink holding portion (not shown) including ink reservoirs, by the partitions of the sealing member.

[0052]

In the ink jet printer 300 of the present embodiment, the printer head 400 of the above-described configuration is detachably mounted, as shown in Figs. 4 and 5, on a carriage 303 of a head moving mechanism 302, and the carriage 303 is supported movably in the main scanning direction, for example by a guide shaft 304.

[0053]

The printer head 400 is provided with the plural external connection terminals 415, ... as explained in the foregoing, and plural external connection terminals (not shown) of an corresponding arrangement are also provided on the carriage 303. Therefore, when the printer head 400 is mounted on the carriage 303, the plural external connection terminals 415, ... of the printer head 400 are respectively connected to those of the carriage 303.

[0054]

In a position opposed to the printer head 400 mounted on the carriage 303, there is provided a platen roller 305 for supporting and conveying a printing sheet P constituting the recording medium, and the platen roller 305, etc. constitute a sheet feeding mechanism 306 for conveying the printing sheet P in successive manner in the sub scanning direction.

[0055]

The head moving mechanism 302 and the sheet feeding

mechanism 306 are connected to a movement control circuit 311, which is in turn connected to a microcomputer 312. The microcomputer 312 comprehensively controls the head moving mechanism 302 and the sheet feeding mechanism 306, thus constituting relative movement means for causing the surface of the printing sheet P to move relative to the ink discharging position of the printer head 400.

[0056]

The microcomputer 312 is also connected to a data input circuit 313 constituting printing input means, a data readout circuit 314 constituting access control means, a communication I/F 315, etc., and the host computer 200 is connected to the communication I/F 315 through the communication cable 210.

[0057]

The data input circuit 313 is connected to the heater logic circuit 417 of the printer head 400 through the carriage 303, and the data readout circuit 315 is connected to the fuse logic circuit 442 of the printer head 400 through a connector of the carriage 303.

[0058]

At the execution of image printing, the data input circuit 313 supplies the heater logic circuit 417 of the printer head 400 with a printing image signal, and, at the execution of image printing, the data readout circuit 314

reads the stored data of the fuse ROM 441 from the fuse logic circuit 442 of the printer head 400.

[0059]

For more detailed explanation, as is shown in Fig. 4, the data input circuit 313 retains the reset signal at the first (low) state at the execution of the image printing, and individually transmits the printing image signal and the printing clock signal thereby causing the heater logic circuit 417 etc. to execute the printing operation.

[0060]

On the other hand, the data readout circuit 314 retains, at the execution of image printing, the reset signal at the second (high) state and transmits the memory clock signal, and serially receives the readout data serially transferred in synchronization therewith from the fuse logic circuit 442.

[0061]

When the reset signal is shifted to the high state, the shift register 422 and the latch circuit 421 are retained in a continued reset state, whereby the printing operation is not executed even if various signals are exchanged through the external connection terminals in such memory access state. As the fuse logic circuit 442 executes the memory access only when the memory clock signal is entered in the high state of the reset signal,

the memory access is not executed during the execution of the printing operation.

[0062]

The microcomputer 312 comprehensively controls the circuits 311, 313 and 314, thereby supplying the printing image signal, entered from the host computer 200 to the communication I/F 315, to the data input circuit 313 and outputs the data, read by the data readout circuit 314 from the printer head 400, to the host computer 200 through the communication I/F 315.

[0063]

The ink jet printer 300 of the present embodiment is also provided with an ink tank (not shown) constituting ink supply means, and such ink tank is connected to the ink supporting portion of the printer head 400 through a socket member (not shown) of the carriage 303. The ink tank is filled in advance with liquid ink and supplies the printer head 400 with such ink.

[0064]

In the image processing system 100 of the above-described configuration of the present embodiment, the host computer 200 supplies the ink jet printer 300 with the printing image signal, which is output by the ink jet printer 300 onto the printing sheet P.

[0065]

In this case, under the control by the microcomputer 312, the head moving mechanism 302 moves the printer head 400 in the main scanning direction, while the sheet feeding mechanism 306 moves the printing sheet P in the sub-scanning direction, and the data input circuit 313 enters the printing image signal into the printer head 400 in synchronization with these operations.

[0066]

The printer head 400 supports, in the ink supporting portions, the ink constantly supplied from the ink tank, and the heater logic circuit 417 selectively drives the plural heater elements 411 according to the entered printing image signal. The liquid ink in the ink supporting portion generate bubbles by the selective heat generation of the plural heater elements, whereby ink droplets are discharged and deposited onto the printing sheet P in relative movement, thereby forming a dot matrix image.

[0067]

In the image processing system 100 of the present embodiment, the printer head 400 is provided with the fuse ROM 441, and the ID code and the function characteristics of the heater unit 412 are recorded in the fuse ROM 441 at a time after the manufacture of the printer head 400 and prior to the shipment thereof.

[0068]

When the printer head 400, shipped after such data recording, is mounted in the ink jet printer 300, it is rendered capable, by the data readout circuit 314, of reading the stored data from the fuse ROM 441 of the printer head 400.

[0069]

The ink jet printer 300 is therefore rendered possible to regulate the electric power supplied to the heater unit 412 according to the function characteristics thereof read from the fuse ROM 441 of the printer head 400 and to inform the host computer 200 of the ID code of the printer head 400.

[0070]

Also in the ink jet printer 300 of the present embodiment, the printer head 400 is provided with the fuse ROM 441 as explained in the foregoing, but the signals for access to such memory are entered by the external connection terminals 423, 425, 426 used for the printing operation.

[0071]

Therefore, it is not required to provide the printer head 400 with the additional terminals exclusive for the access to the fuse ROM 441, thereby allowing to reduce the dimension and weight of the printer head 400 and to improve

the production capability thereof. Similarly it is not required to provide the carriage 300 with the additional terminals, so that the ink jet printer 300 can be realized more compact and lighter with improved production capability.

[0072]

As various signals in the printing operation are utilized for the signals for memory access as explained in the foregoing, the data readout circuit 314 and the data input circuit 313 can be formed in common in a large proportion of the hardware in the ink jet printer 300, whereby the ink jet printer 300 can be simpler in structure and smaller in dimension and weight.

[0073]

The present invention is limited to the foregoing embodiment but includes various modifications within the scope of technical concept of the present invention. For example, the foregoing embodiment has shown an ink jet printer of electrothermal conversion type, but the present invention is applicable to the printer of various types in which the printer head is replaceable.

[0074]

Also in the foregoing embodiment, the ink jet printer 300 and the printing head 400 utilize a data terminal 426 for serially transferring the printing image signal and the

data read from the fuse ROM 441, but these may be transferred in parallel through plural external connection terminals.

[0075]

Also in the foregoing embodiment, the fuse ROM 441 and the fuse logic circuit 442 are formed, together with the heater unit 412 and the heater logic circuit 417, on a single base substrate 410 with layered structure, but it is also possible to mount an independent chip constituting the fuse ROM 441 or the fuse logic circuit 442 on the base substrate 410.

[0076]

Also in the foregoing embodiment, the reset signal for the shift register 422 and the latch circuit 421 is used as the access permission signal for the fuse logic circuit 442, but it is also possible, as in the case of a head substrate 500 shown in Fig. 5, to utilize the latch signal for the latch circuit 421, entered externally to the clock terminal 424, for this purpose.

[0077]

Also in the foregoing embodiment, the shift register 422 and the latch circuit 421 utilize a reset signal in common, but there may be employed separate signals for this purpose, and, in such case either of such signals may be utilized as the access permission signal for the fuse logic

circuit 442.

[0078]

Also in the foregoing embodiment, the ink jet printer 300 causes the fuse logic circuit 442 to only execute the readout of the data stored in the fuse RPM 1441, but it is also possible to execute the data writing or to selectively execute the data readout and the data writing.

[0079]

However, if the content of the memory access is increased as explained above, there are required control signals therefor and it is preferable, as in the head substrate 510 shown in Fig. 6, to connect the fuse logic circuit 442 to four external connection terminals 423 to 426.

[0080]

It is already explained that the mutual erroneous operations do not occur between the printing operation and the memory access in the foregoing embodiment, but, if it is desired to more strictly prevent such erroneous operations, it is preferable, as in the head substrate 520 shown in Fig. 7, to additionally provide an external connection terminal 521 exclusive for externally entering the enable signal for the memory access.

[0081]

It is also possible, as in the head substrate 530

shown in Fig. 8, to connect the heater power supply terminals 415, 416 for supplying the heater unit 412 with the driving electric power, also to the fuse logic circuit 442, thereby dispensing with the exclusive memory power supply terminals 447, 448 for supplying the fuse logic circuit 442 with the driving electric power.

[0082]

In this case, there are not exclusive external connection terminals connected to the fuse logic circuit 442, so that the printer head and the printer utilizing a head substrate 530 can be made satisfactorily small and light. It is likewise possible to connect the fuse logic circuit 442 to the power supply terminals 432, 433 thereby dispensing with the heater power supply terminals 415, 416.

[0083]

Also in the foregoing printer head 400, the presence or absence of the operation of the heater unit 412 is eventually determined by the presence or absence of the printing pulse signal externally entered into the pulse terminal 420, so that it is possible to utilize various signals of the fuse logic circuit 417 for the memory access operation by terminating the printing pulse signal at the execution of the memory access.

[0084]

[Advantage of the Invention]

Since the present invention is thus arranged as is explained above, the following effects can be obtained.

[0085]

When the printer head having the head substrate of this invention is mounted to the printer main body, at the execution of the printing operation, various signals for the printing operation are supplied from the printer main body to the external connection terminals of the head substrate. When the printing execution means can execute the printing operation when the printing image signal and the printing clock signal are externally entered in the first state of the binary logic signal, at the execution of memory access, various signals for the memory access are supplied from the printer main body to the external connection terminals of the head substrate. Therefore, the memory access means can execute access to the data memory means in a timing corresponding to the memory clock signal, when the access permission signal is externally entered. Since the terminal sharing means supplies the memory access means with the binary logic signal entered into the external connection terminal and such memory access means recognizes the binary logic signal of the second state as the access permission signal, there is not required the terminal exclusive for transferring such access permission signal to the memory access means, so that the printer head

and the printer as well as the head substrate can be made smaller and lighter and superior in the production capability.

[0086]

In the above-described head substrate, the printing execution means prints the printing image signal serially input at a specified one of the external connection terminals, and the terminal sharing means serially supplies the memory access means with the input signal at the single external connection terminal, at which the recording image signal is serially entered, as the writing data. Therefore, the input of the printing image signal and the writing data can be implemented by a single external connection terminal.

[0087]

In the above-described head substrate, the printing execution means prints the printing image signal serially input at a specified one of the external connection terminals, and the terminal sharing means serially supplies an external connection terminal, serially receiving the printing image signal, with the data read from the memory access means. Therefore, the input of the printing image signal and output of the read data can be implemented by a single external connection terminal.

[0088]

In the above-described head substrate, the printing

execution means prints the printing image signal input in parallel at multiple specified external connection terminals, and the terminal sharing means supplies the memory access means in parallel with the input signals of plural external connection terminals receiving parallel input of the printing image signal. Therefore, high-speed input of the recording image signal and the writing data can be implemented.

[0089]

In the above-described head substrate, the printing execution means prints the printing image signal input in parallel at specified ones of the external connection terminals, and the terminal sharing means supplies the plural external connection terminals, receiving parallel input of the printing image signal, in parallel manner with data read from the memory access means. Therefore, high-speed execution of input of the printing image signal and output of the read data can be implemented.

[0090]

In the above-described head substrate, the printing execution means includes: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of external connection terminal and is

serially input to another specified external connection terminal, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the shift register as a binary logic signal that serves as an access permission signal, so that an existing signal can be used as an access permission signal, and the circuit configuration of the printer can be simplified.

[0091]

In the above-described head substrate, the printing execution means includes: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of the external connection terminals and is serially entered to another specified external connection terminal; and a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally entered at a specified one of the external connection terminals and is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the latch circuit as a binary logic signal that serves as an access permission signal, so that an existing signal can be used as an access permission signal, and the circuit configuration of the printer can be

simplified.

[0092]

In the above-described head substrate, the printing execution means includes: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at a one specified of the external connection terminals and is serially input to another specified external connection terminal; and a latch circuit for temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal and is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal as a binary logic signal that serves as an access permission signal, so that an existing signal can be used as an access permission signal, and the circuit configuration of the printer can be simplified.

[0093]

In the above-described head substrate, the printing execution means includes: a shift register for, at a timing corresponding to a printing clock signal, temporarily holding and outputting in parallel a printing image signal that is reset by a reset signal externally input at one specified external connection terminal and is serially

entered to another specified external connection terminal; and a latch circuit for, at a timing corresponding to a latch signal externally entered to a specific one of the external connection terminals, temporarily holding and outputting in parallel a printing image signal that is output in parallel from the shift register, wherein the terminal sharing means transmits, to the memory access means, the reset signal of the latch circuit as a binary logic signal that serves as an access permission signal, so that an existing signal can be used as an access permission signal, and the circuit configuration of the printer can be simplified.

[0094]

In the above-described head substrate, the printing execution means is provided with plural recording elements for outputting the printing image signal output in parallel from the latch circuit, corresponding to a printing pulse signal externally input to a specified one of the external connection terminals, whereby various signals utilized in the printing operation can be utilized for the memory access by terminating the printing pulse signal for the recording elements at the execution of the memory access.

[0095]

In the above-described head substrate, the terminal sharing means supplies the memory access means with the

recording clock signal of the shift register as the memory clock signal, thereby allowing to utilize an existing signal as the memory clock signal and to simplify the circuit configuration of the printer apparatus.

[0096]

In the above-described head substrate, the data memory means executes both data writing and data readout as the memory access operation, while the memory access means selectively executes either of data writing and data readout according to an externally entered mode switching signal, and the terminal sharing means supplies the memory access means with the input signal to a specified one of the external connection terminals, whereby the data memory means can execute both data writing and data readout.

[0097]

In the above-described head substrate, the recording execution means externally receives the driving electric power from a specified external connection terminal, and the terminal sharing means supplies the memory access means with the driving electric power for the recording execution means, thereby allowing to dispense with the external connection terminal for supplying the memory access means with the driving electric power and to reduce the dimension and weight of the printing head and the printer.

[0098]

In the above-described head substrate, the external connection terminals, printing execution means, data memory means, memory access means and terminal sharing means are composed of films formed on a base substrate, whereby the printer head can be formed compact and light.

[Brief Description of the Drawings]

[Fig. 1]

This is a block diagram showing the circuit configuration of a head substrate according to an embodiment of the present invention.

[Fig. 2]

This is an external perspective view of a printer.

[Fig. 3]

This 3 is a schematic block diagram showing the circuit configuration of the printer.

[Fig. 4]

This is a block diagram showing the circuit configuration of a modification of the head substrate.

[Fig. 5]

This is a block diagram showing the circuit configuration of a second modification of the head substrate.

[Fig. 6]

This is a block diagram showing the circuit configuration of a third modification of the head substrate.

[Fig. 7]

This is a block diagram showing the circuit configuration of a fourth modification of the head substrate.

[Fig. 8]

This is a block diagram showing the circuit configuration of a fifth variation of the head substrate.

[Description of Reference Numbers]

300: ink-jet printer as a printer

313: data input circuit as a printing input circuit

314: data reading circuit as access control means

400: printer head

401, 500, 510, 520, 530: head substrate

410: base substrate

411: heater element as a printing element

415. 416: heater power terminal as an external connection terminal

417: heater logic circuit

419: block terminal as an external connection terminal

420: pulse terminal as an external connection terminal

423: reset terminal as an external connection terminal

424, 425: clock terminal as an external connection

terminal

426: data terminal as an external connection terminal

431: sensor terminal as an external connection terminal

441: fuse ROM as data memory means

442: fuse logic circuit as memory access means

444: signal wiring as terminal sharing means

P: printing sheet as a recording medium

[Name of Document] Abstract

[Abstract]

[Objective] The object is to enable memory access, without more external connection terminals being provided when a data memory is mounted to a printer head.

[Structure] A binary signal that is not changed at the execution of a printing operation is employed as a memory access permission signal.

[Selected Figure] Fig. 1

[Name of the Document] Authorized Correction Data

[Document to be corrected] Patent Application

<Recognition Information / Additional Information>

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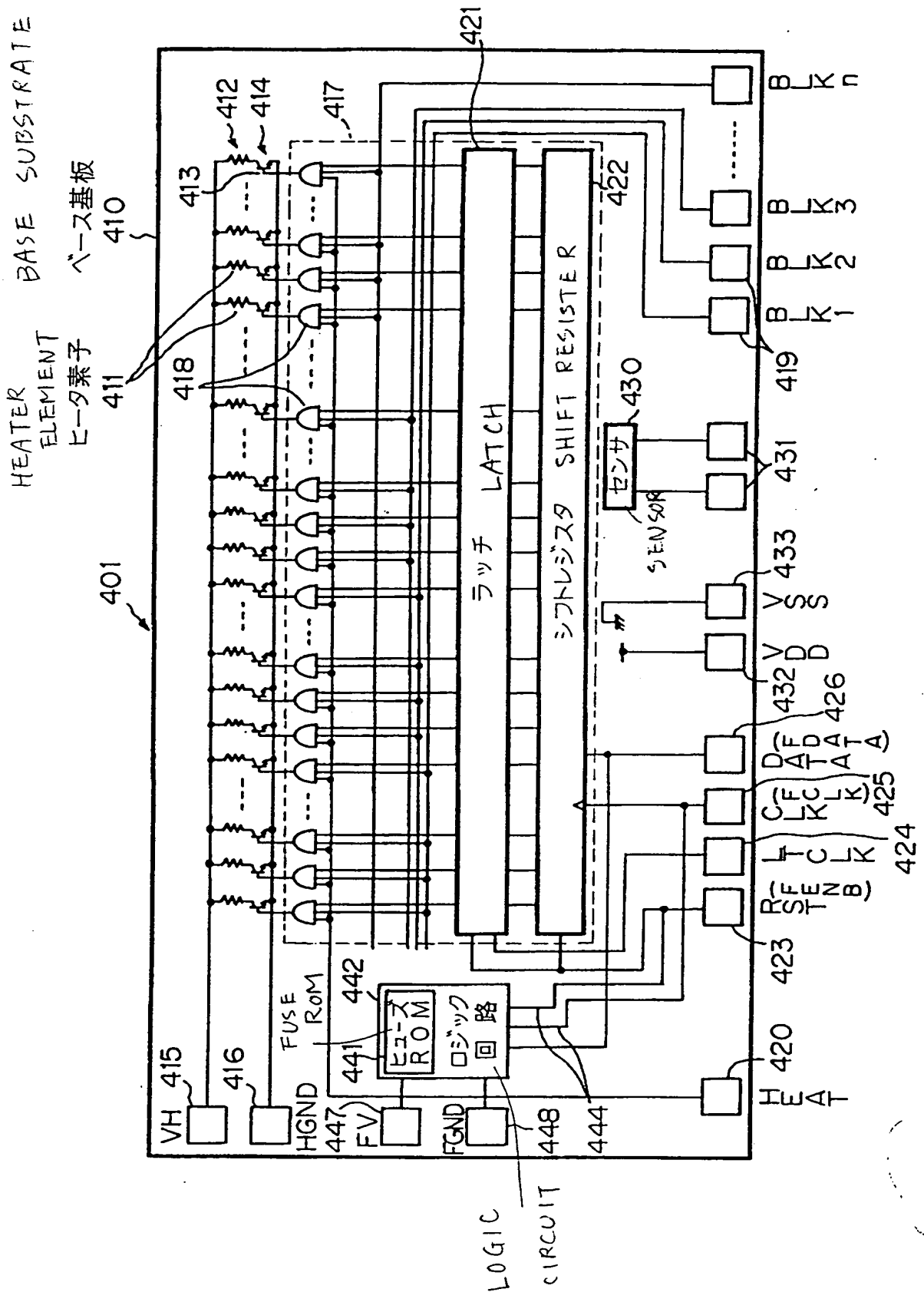
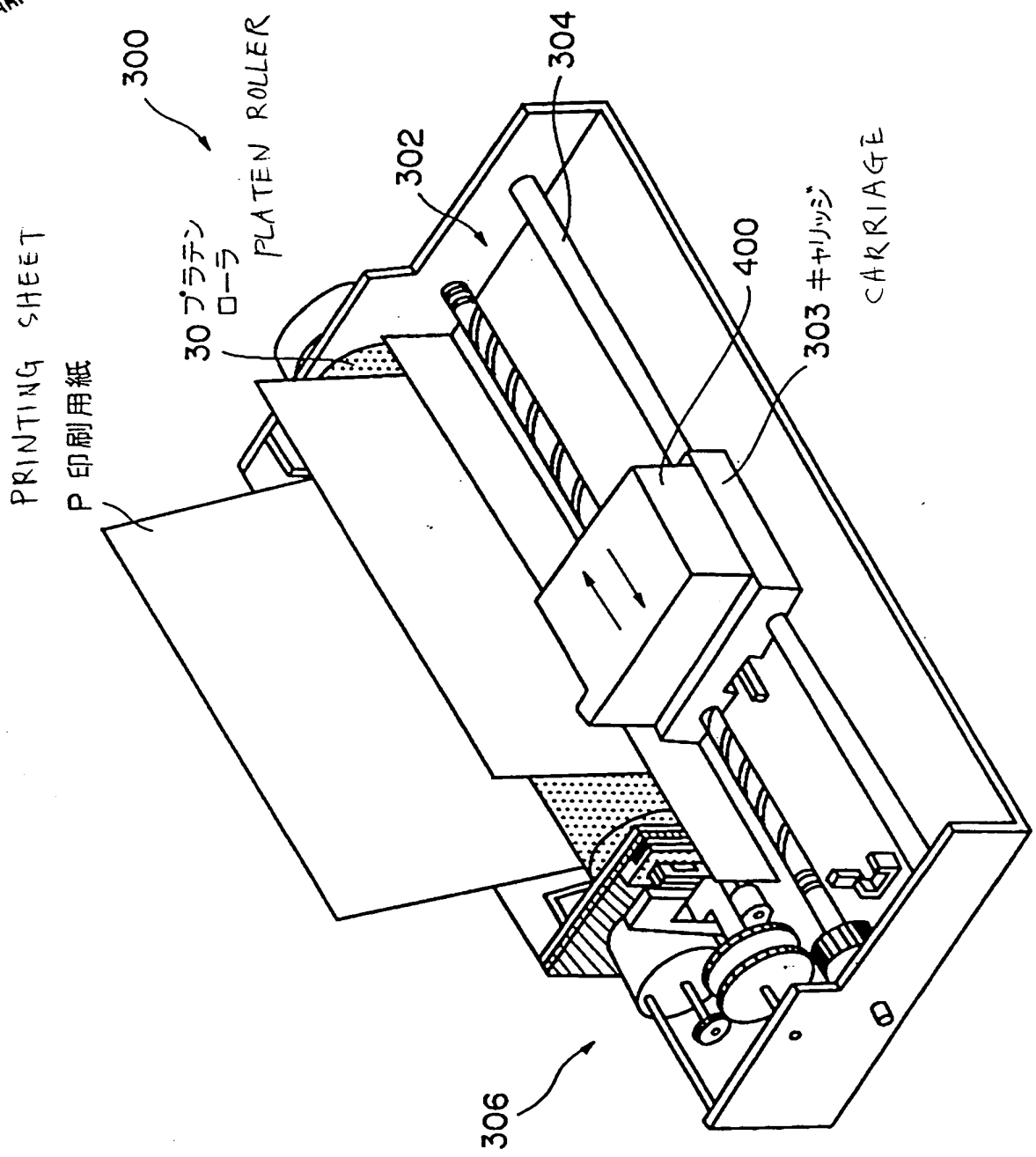
【書類名】　図面　Name of Document

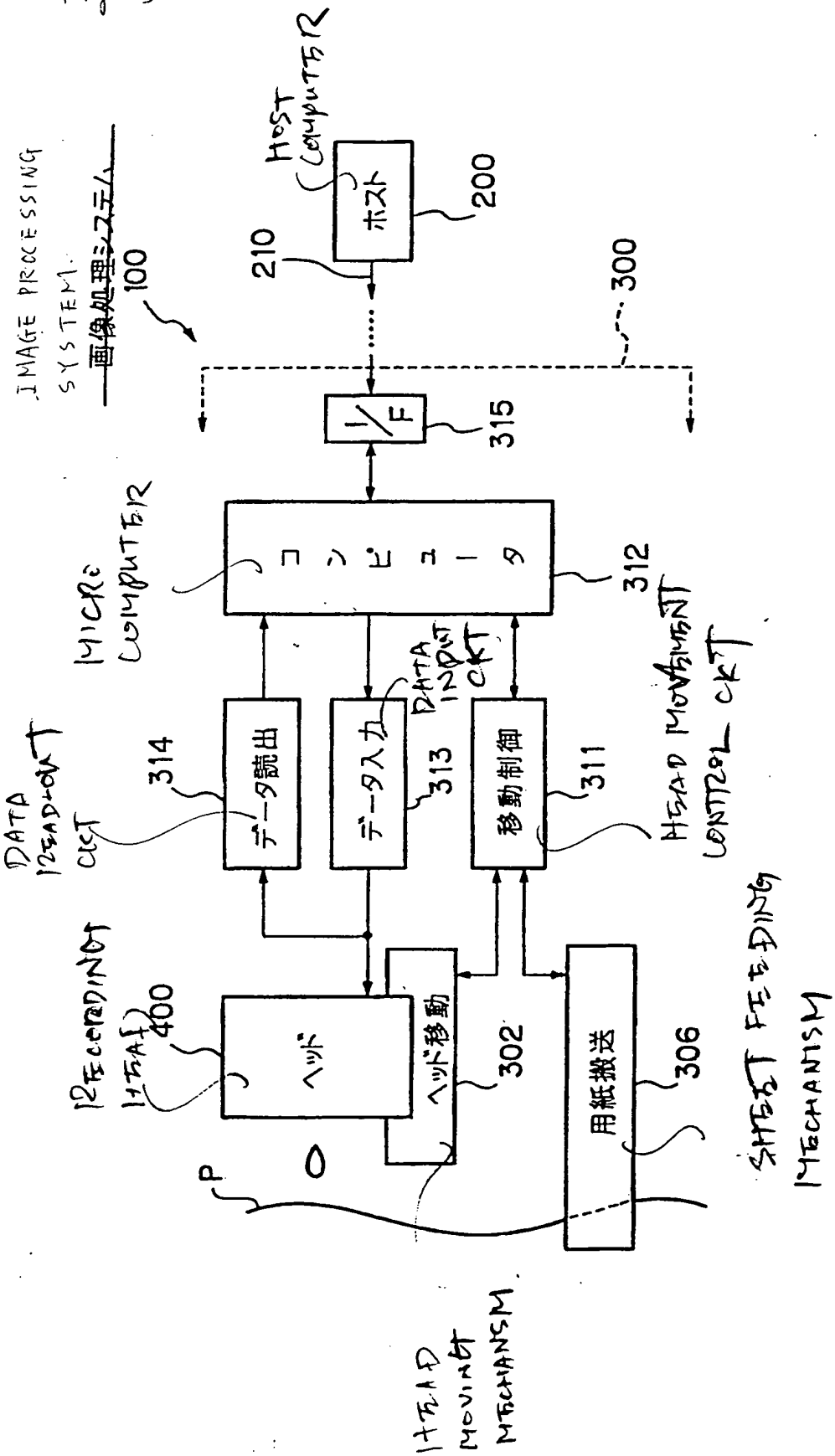
【図１】　Fig. 1　Drawings



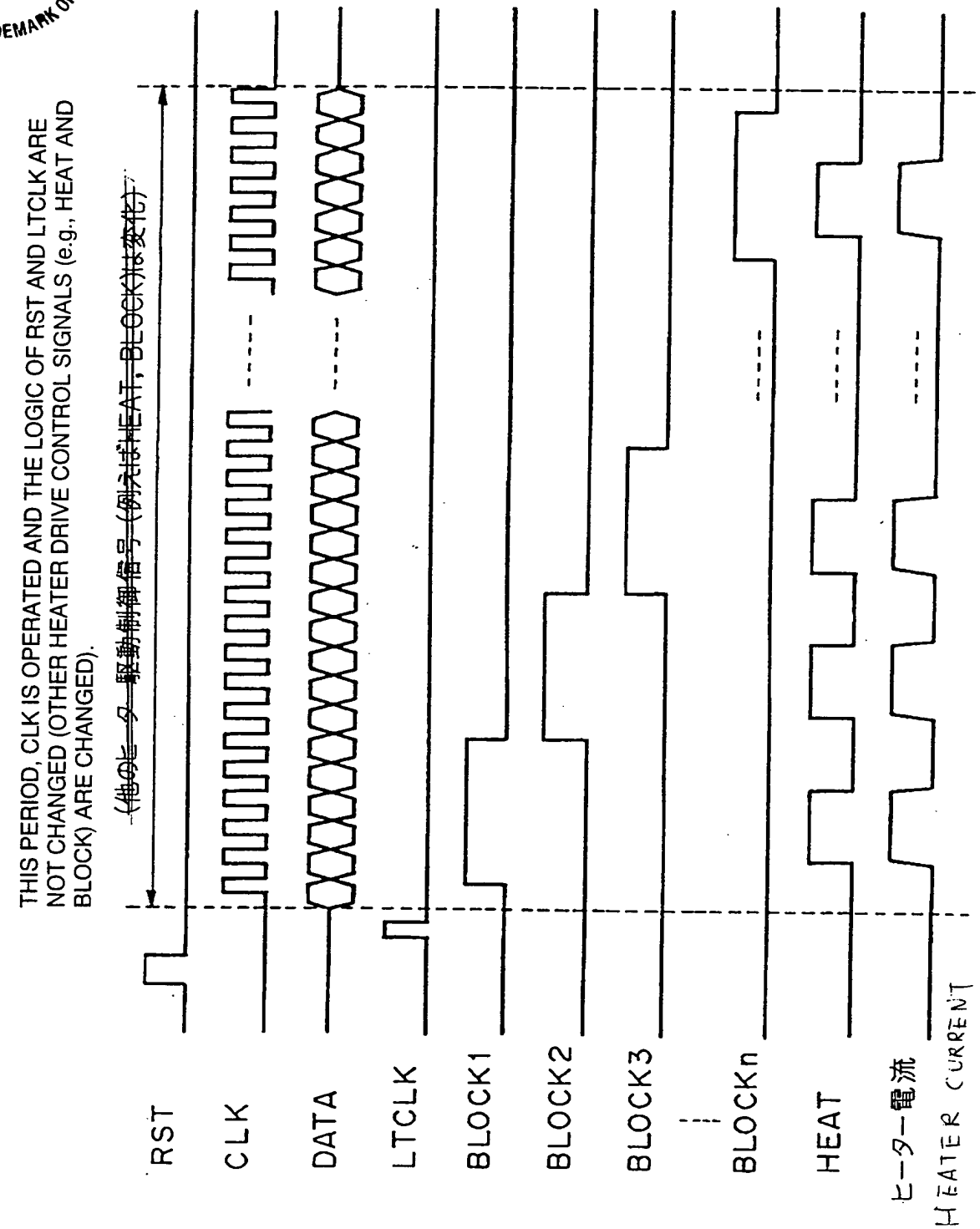
【図２】 Fig 2



【図３】 Fig. 3



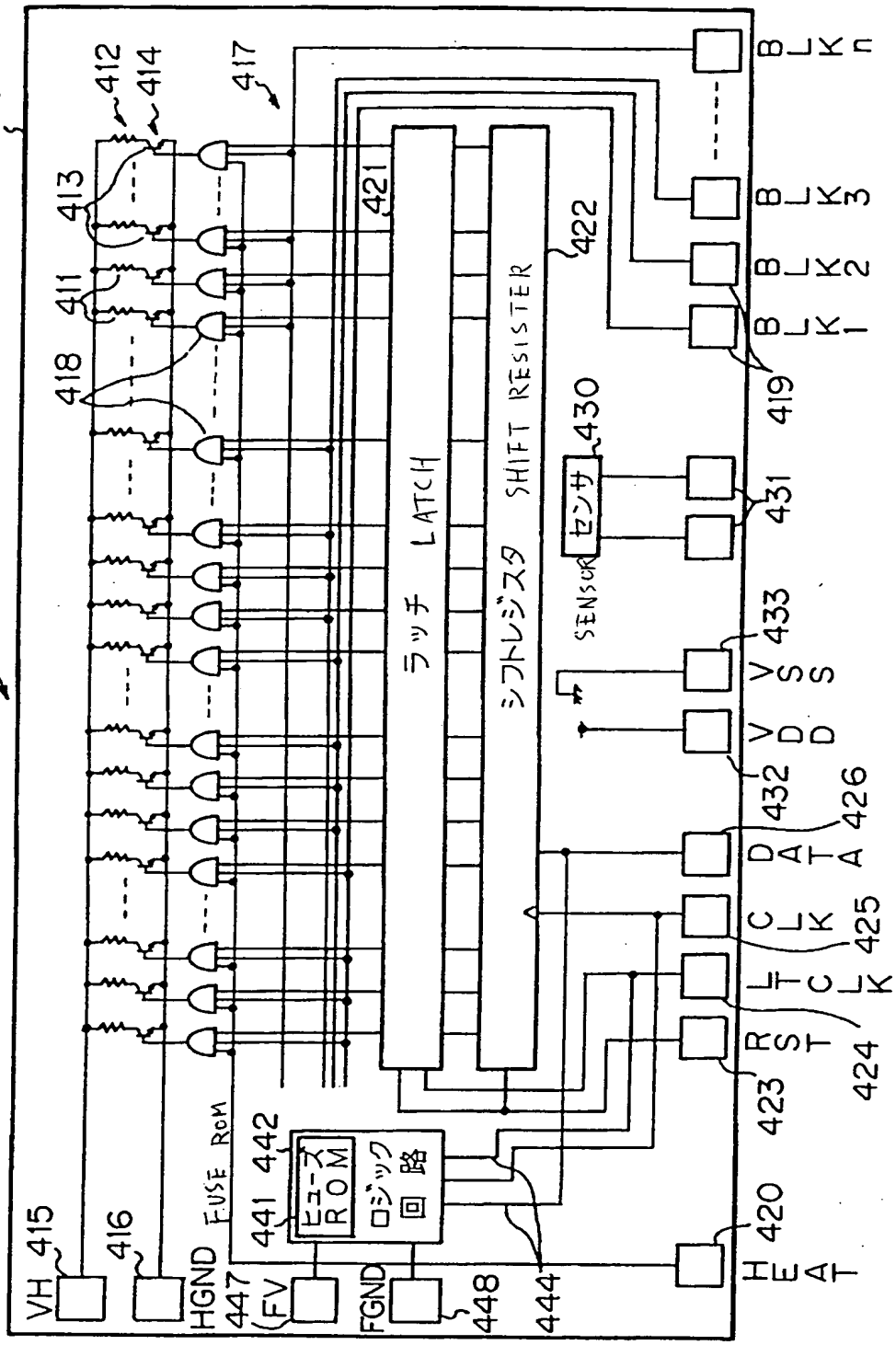
【図４】 Fig. 4



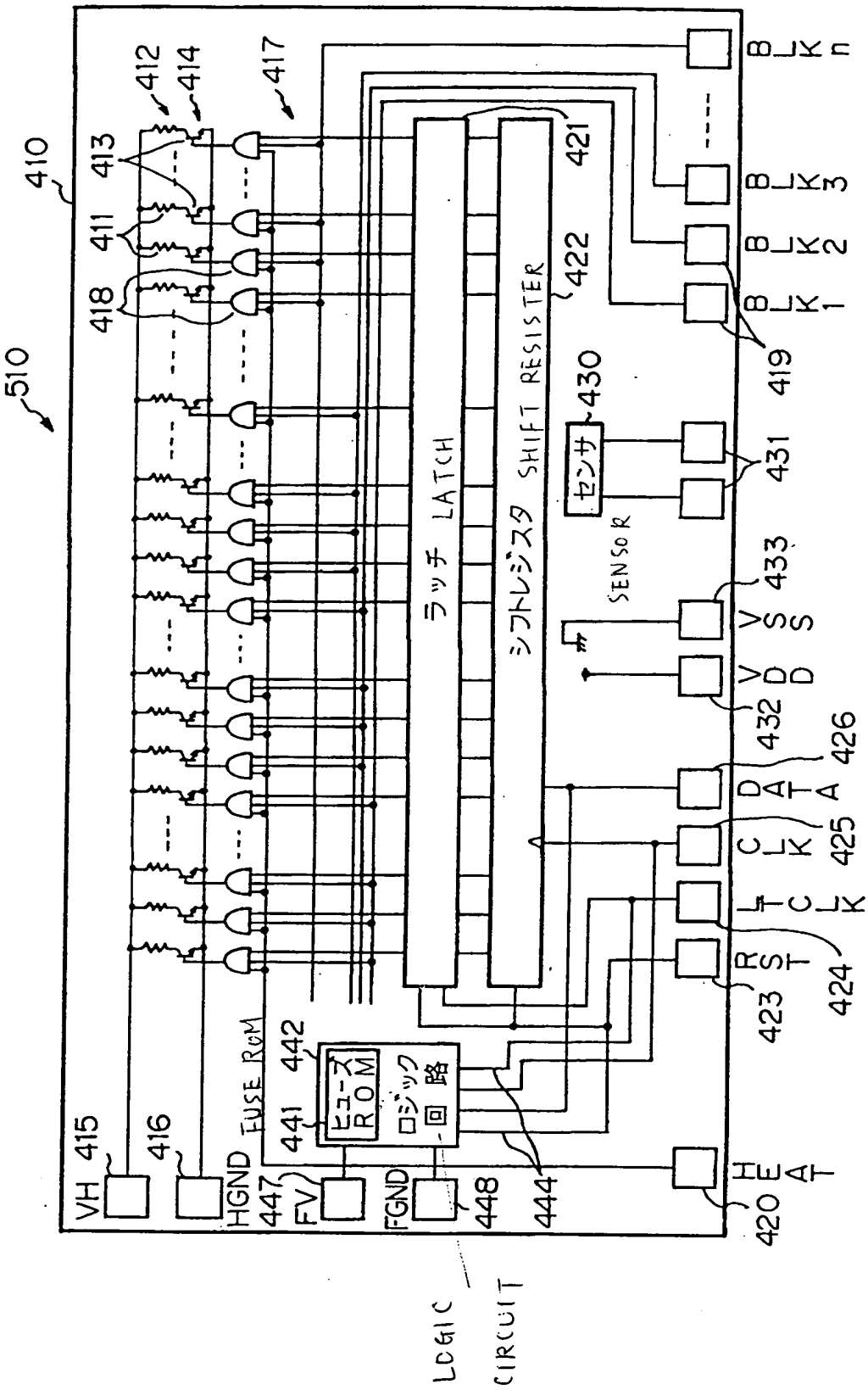
THIS PERIOD, CLK IS OPERATED AND THE LOGIC OF RST AND LTCLK ARE NOT CHANGED (OTHER HEATER DRIVE CONTROL SIGNALS (e.g., HEAT AND BLOCK) ARE CHANGED).

~~(他のヒータ駆動制御信号（例えばHEAT，BLOCK）は変化)~~

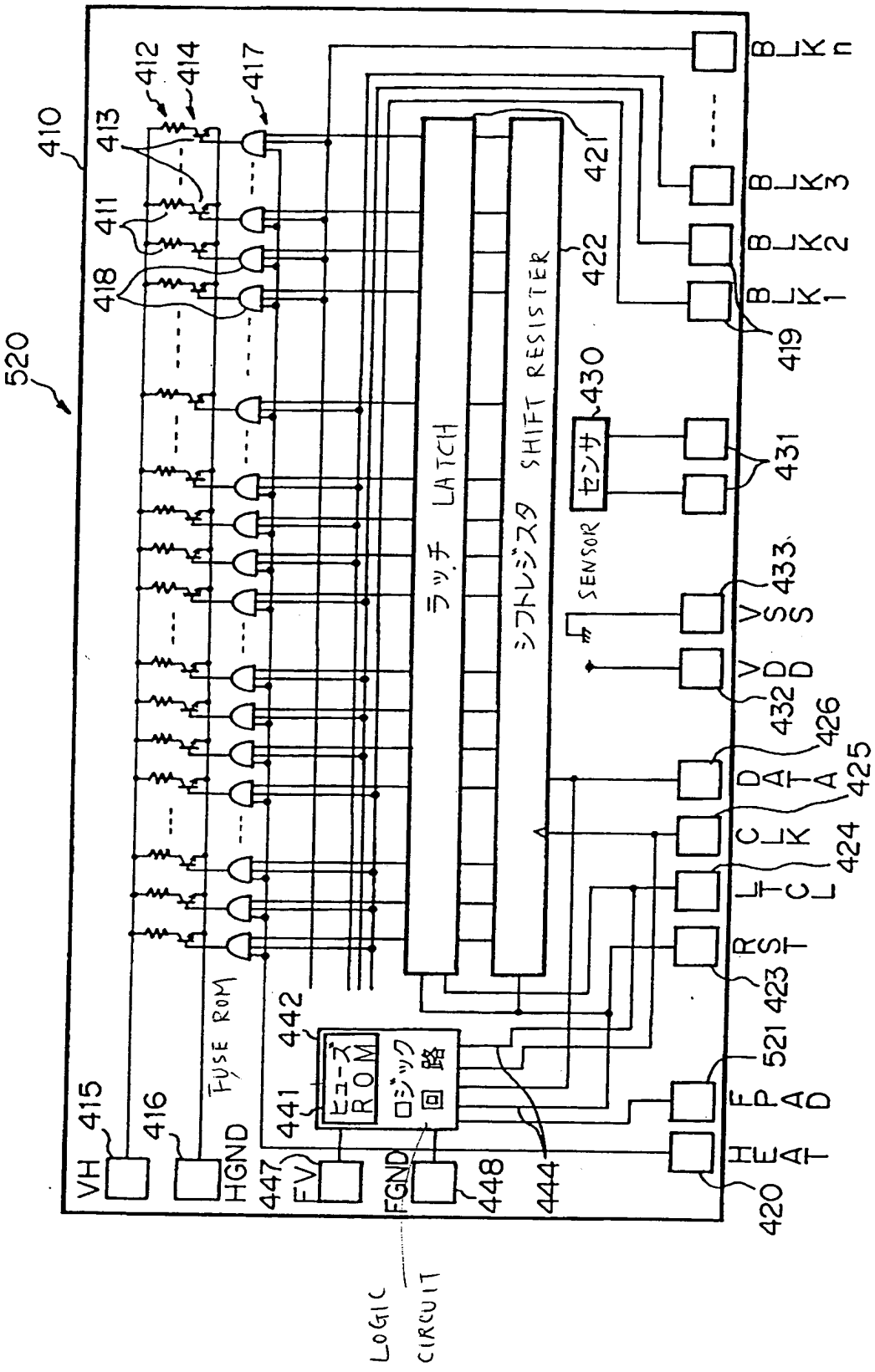
【図５】 Fig. 5



【図６】 Fig.6



【図７】 Fig. 7



【図８】　Fig. 8